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NEW SUGAR-BEET VARIETIES FOR THE CURLY-TOP AREA

Prepared by the *Division of Sugar Plant Investigations, Bureau of Plant Industry*

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The curly-top-resistant sugar-beet variety U. S. 1 came into widespread use in the western United States as soon as seed supplies became available. Approximately 35,000 acres were planted with U. S. 1 in 1934, the first year seed was available to the farmers. In 1935, with increased recognition of its merits and with larger available seed supplies, 102,803 acres were planted with this variety.

This extensive culture has proved that by planting the resistant variety early and giving good cultural care, a complete failure of the sugar-beet crop could be avoided even under severe curly-top conditions; under milder exposures, profitable yields were obtained. The curly-top damage to the U. S. 1 was often serious, however, and the variety lacked other desirable characteristics. Accordingly, breeding to develop further improved varieties has been continued.

U. S. 33 AND U. S. 34

Two new varieties, U. S. 33 (fig. 1) and U. S. 34, developed by the United States Department of Agriculture are now ready for utilization by sugar-beet growers. These varieties were obtained by critical and extensive mass selection from U. S. 1 in fields where curly-top exposure was extreme. F. V. Owen and F. A. Abegg, of the Division of Sugar Plant Investigations, Bureau of Plant Industry, in the fall of 1931 selected approximately 10,000 beet roots from fields of U. S. 1 in southern Idaho. These roots were tested for quality by means of the refractometer and about 1,100 saved. From this number, 100 which showed on analysis the highest sucrose percentage were planted in one place and produced the parent stock of seed of U. S. 33, amounting to 2½ pounds. The remaining 1,000 roots gave rise to U. S. 34. Only a small number of the 1,000 lot actually produced seed—a total of 57 pounds—indicating that curly top operated to limit seed production to the more resistant plants.

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The small initial lots of U. S. 33 and U. S. 34 seed were increased by field plantings for seed production.[1] In 1933, 250 pounds of U. S. 33 and 857 pounds of U. S. 34 were produced. In 1934, 6,190 pounds of U. S. 33 were produced. Portions of these seed lots were supplied to beet-sugar companies for further increase and distribution to growers, under a cooperative agreement between the United States Department of Agriculture and the companies.

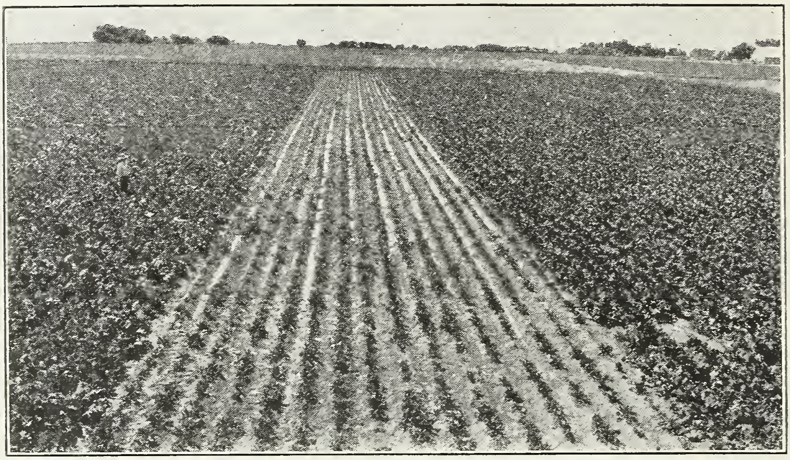

FIGURE 1.—Test of curly-top-resistant varieties at Twin Falls, Idaho, in 1935. Left, U. S. 33; center, commercial variety; right, no. 600.

PERFORMANCE OF U. S. 33 AND U. S. 34

Agronomic tests [2] were conducted during the past three seasons under a wide range of conditions. The U. S. 1 variety was included in these tests, and its performance may be used as a standard by which to measure and describe the two new varieties.

Both U. S. 33 and U. S. 34 were found to have improved curly-top resistance over that of U. S. 1. The difference was more marked in U. S. 34. Under conditions representative of extremely severe curly-top exposure, where U. S. 1 produced 7.4 tons per acre, the yield of U. S. 34 was 11.4 tons per acre. Under less severe exposure, the acre yield of U. S. 1 was 9.5 tons, and that of U. S. 34 was 17.7 tons. In view of the fact that under good soil conditions and favorable cultural care, commercial fields of U. S. 1 are seldom so severely injured by curly top as to reduce the acre yield below 9 tons, it is obvious that U. S. 34 is a distinct improvement over U. S. 1 in curly-top resistance and will afford fairly high yields under moderate curly-top exposure.

The curly-top resistance of the variety U. S. 33 is slightly better than that of U. S. 1, as a few yield comparisons will indicate. In one test the acre yield of U. S. 1 was 7.4 tons, in comparison with 8.5 tons for U. S. 33. Under somewhat less drastic exposure, the yield from U. S. 1 was 9.5 tons per acre while that from U. S. 33 was 11.8 tons per acre. The same general order of results has come from repeated trials, and it may be said that, under curly-top exposure, better yields can be expected from U. S. 33 than from U. S. 1.

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[1] Seed increase of U. S. 34 to an amount sufficient for preliminary test and to provide planting stock for commercial increase was made at the New Mexico Agricultural Experiment Station in connection with cooperative investigations on sugar-beet seed production. Seed of U. S. 33 was increased at the U. S. Sugar Plant Field Station at Salt Lake City, Utah, and then a subsequent increase was made at State College, N. Mex.

[2] Field tests in addition to those conducted by F. V. Owen and F. A. Abegg were carried on in Idaho by C. E. Cormany and A. M. Murphy; in Utah, by J. O. Culbertson; and in California, by Charles Price and F. G. Larmer.

The sucrose percentage of U. S. 34 was slightly lower than that of U. S. 1 in some instances, but on the average the two varieties probably are not significantly different in this respect. U. S. 33, on the other hand, shows a small but significant increase in sucrose percentage over that of U. S. 1. On the basis of these tests, U. S. 34 may be expected to produce more sugar per acre than U. S. 1 under conditions where curly top is an important factor, and U. S. 33 should produce more sugar per acre than U. S. 1 whether curly top is a factor or not.

BOLTING TENDENCY OBJECTIONABLE FOR WINTER PLANTING

The tendency to bolt or develop seedstalks prematurely in some areas is an objectionable characteristic of U. S. 1. There is, in general, relatively little bolting in this variety in southern Idaho, and therefore there was very little opportunity to avoid bolting tendency in making the selections which gave rise to U. S. 33 and U. S. 34. In spite of this limited opportunity, however, some improvement in regard to bolting was made. The extent of this improvement may be indicated by the results of a test near Salinas, Calif., planted December 6, 1934. The percentages of bolters were as follows: U. S. 1, 90.8; U. S. 33, 40.4; U. S. 34, 62.6. The fact that the new varieties are somewhat improved is of interest. Much more improvement in this regard is needed, however, before resistant curly-top varieties can be recommended for planting in December and early January in California. This fact becomes more evident when it is noted that in the test where the bolting in U. S. 33 was 40.4 percent, there was a widely used European variety which bolted only 7.8 percent. Even though U. S. 33, because of its bolting tendency, cannot be satisfactorily planted in early winter or midwinter in this area, it may safely be planted earlier in the spring than U. S. 1. This is important because early planting generally augments the advantage gained by the use of curly-top-resistant varieties.

CHOICE OF VARIETIES FOR GIVEN LOCALITIES

For areas regularly made marginal by curly top, U. S. 34 should be used in preference to U. S. 33, because of its greater resistance to curly top. In areas where less damage from the disease is to be expected, either U. S. 33 or U. S. 34 might be superior in a given season because of the particular conditions prevailing.

Sufficient seed supplies of U. S. 34 will be available in the spring of 1936 to plant a large portion of the acreage for which a curly-top resistant variety is desired. Large seed supplies of U. S. 33 will not be available for use until 1937. Before the planting season of 1937, it is hoped to have additional information indicating more definitely the suitability of the two varieties for particular localities.

Another curly-top-resistant variety, no. 600, also should be considered. The origin of no. 600 is described by officials of the Amalgamated Sugar Co. as follows:

> Dr. Katherine Esau, formerly with the Spreckels Sugar Co., and now with the University of California, furnished a resistant hybrid strain known as P 19× 905a2. Six plants chosen from this hybrid were again hybridized with six plants from a commercial variety. The latter were exceptional in also showing some resistance to curly top. This triple hybrid seed from the 12 plants in the isolation became known as no. 600 and has now been extensively propagated.

No. 600 has not been so thoroughly tested under Government supervision as have U. S. 33 and U. S. 34, but it is known to be very highly resistant to curly top. It also yields well, having outyielded U. S. 33 and U. S. 34 in some instances during the 1935 season, both under disease-free conditions and under severe curly-top exposures. The sucrose percentage, however, has generally been somewhat lower, so that its acre yield has not often surpassed those of the other varieties. Because of its high resistance to curly top, no. 600 can be considered with U. S. 34 for areas where this disease may be expected to be most severe.

BREEDING PROGRAM BEING CONTINUED

The partial control of curly top through the use of the resistant varieties here described will permit the continuance of the beet industry in many regions where its existence has been threatened. Moreover, so far as the curly-top limitation is concerned, it will now be possible for sugar-beet growing to be resumed in large areas from which the industry has been driven by the disease. Nevertheless, curly-top control has not yet been accomplished. Thus, for example, under exposure to the disease so severe as to cause abandonment of fields planted with the European varieties, U. S. 34 might produce 15 to 20 tons per acre instead of the 25 tons to be expected in the absence of the disease. Losses and uncertainties such as these may be further curtailed by the development of more resistant varieties. Opportunities of improvement by reducing bolting tendency and obtaining better adaptation to general and localized conditions also exist. The breeding program of the Bureau of Plant Industry accordingly is being continued with these elements in mind.

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